Installation and Configuration Guide

HP StorageWorks Linux Kit for Enterprise Virtual Array

Product Version: 3.0e

Fourth Edition (July 2004)

Part Number: AA-RUHVD-TE

This guide describes how to install and configure Linux servers with an Enterprise Virtual Array.

Printed in the U.S.A.

Linux Kit for Enterprise Virtual Array Installation and Configuration Guide
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About this Guide

This installation and configuration guide provides information to help you:

- Become familiar with the Enterprise Virtual Array technology
- Install the Linux Kit for Enterprise Virtual Array storage systems
- Test connections to the Enterprise Virtual Array storage systems

“About this Guide” topics include:

Overview

This section covers the following topics:

Intended audience

This book is intended for use by storage administrators who are experienced with the following:

- Configuration of storage area networks (SANs).
- Host environments, such as Windows 2000, Windows NT, Windows Server 2003, Sun Solaris, OpenVMS, Tru64 UNIX, HP-UX, IBM AIX, Linux, and Novell NetWare.
- Enterprise Virtual Array (EVA5000 or EVA3000) storage systems.

Related documentation

In addition to this guide, HP provides corresponding information:

- *HP StorageWorks Linux Kit V3.0e for Enterprise Virtual Array Release Notes*
- *HP StorageWorks Enterprise Virtual Array User Guide*
- *HP StorageWorks Enterprise Virtual Array Release Notes*
- *HP StorageWorks Enterprise Virtual Array Read Me First*
- *HP StorageWorks Enterprise Virtual Array World Wide Name Label*
- *HP StorageWorks Command View EVA Interactive Help File*
- *HP StorageWorks Enterprise Virtual Array Hardware Configuration Guide*
- *HP StorageWorks Enterprise Virtual Array Changing Versions Instructions*
- *HP StorageWorks System Software Enterprise Virtual Array Installation Instructions*
- *HP StorageWorks SAN Design Reference Guide*
- *HP StorageWorks Storage System Scripting Utility Reference Guide Design*
- *HP StorageWorks Using the QLogic 7.00.03 Driver for Single-path or Multi-path Failover Mode on Linux Systems Application Note*

Conventions

Conventions consist of the following:

- Document conventions
- Text symbols
- Equipment symbols

Document conventions

This document follows the conventions in Table 1.

Table 1: Document conventions

Convention	Element
Blue text: Figure 1	Cross-reference links
Bold	Menu items, buttons, and key, tab, and box names
Italics	Text emphasis and document titles in body text
`Monospace font`	User input, commands, code, file and directory names, and system responses (output and messages)
`Monospace, italic font`	Command-line and code variables
Blue underlined sans serif font text (http://www.hp.com)	Web site addresses

Text symbols

The following symbols may be found in the text of this guide. They have the following meanings:

WARNING: Text set off in this manner indicates that failure to follow directions in the warning could result in bodily harm or death.

Caution: Text set off in this manner indicates that failure to follow directions could result in damage to equipment or data.

Tip: Text in a tip provides additional help to readers by providing nonessential or optional techniques, procedures, or shortcuts.

Note: Text set off in this manner presents commentary, sidelights, or interesting points of information.

Equipment symbols

The following equipment symbols may be found on hardware for which this guide pertains. They have the following meanings:

Any enclosed surface or area of the equipment marked with these symbols indicates the presence of electrical shock hazards. Enclosed area contains no operator serviceable parts.

WARNING: To reduce the risk of personal injury from electrical shock hazards, do not open this enclosure.

Any RJ-45 receptacle marked with these symbols indicates a network interface connection.

WARNING: To reduce the risk of electrical shock, fire, or damage to the equipment, do not plug telephone or telecommunications connectors into this receptacle.

Any surface or area of the equipment marked with these symbols indicates the presence of a hot surface or hot component. Contact with this surface could result in injury.

WARNING: To reduce the risk of personal injury from a hot component, allow the surface to cool before touching.

Power supplies or systems marked with these symbols indicate the presence of multiple sources of power.

WARNING: To reduce the risk of personal injury from electrical shock, remove all power cords to completely disconnect power from the power supplies and systems.

Any product or assembly marked with these symbols indicates that the component exceeds the recommended weight for one individual to handle safely.

WARNING: To reduce the risk of personal injury or damage to the equipment, observe local occupational health and safety requirements and guidelines for manually handling material.

Rack stability

Rack stability protects personnel and equipment.

WARNING: To reduce the risk of personal injury or damage to the equipment, be sure that:

- The leveling jacks are extended to the floor.
- The full weight of the rack rests on the leveling jacks.
- In single rack installations, the stabilizing feet are attached to the rack.
- In multiple rack installations, the racks are coupled.
- Only one rack component is extended at any time. A rack may become unstable if more than one rack component is extended for any reason.

Getting help

If you still have a question after reading this guide, contact an HP authorized service provider or access our web site: http://www.hp.com.

HP technical support

Telephone numbers for worldwide technical support are listed on the following HP web site: http://www.hp.com/support/. From this web site, select the country of origin.

Note: For continuous quality improvement, calls may be recorded or monitored.

Be sure to have the following information available before calling:

- Technical support registration number (if applicable)
- Product serial numbers
- Product model names and numbers
- Applicable error messages
- Operating system type and revision level
- Detailed, specific questions

HP storage web site

The HP web site has the latest information on this product, as well as the latest drivers. Access storage at: http://www.hp.com/country/us/eng/prodserv/storage.html. From this web site, select the appropriate product or solution.

HP authorized reseller

For the name of your nearest HP authorized reseller:

- In the United States, call 1-800-345-1518
- In Canada, call 1-800-263-5868
- Elsewhere, see the HP web site for locations and telephone numbers: http://www.hp.com.

Understanding the Enterprise Virtual Array

1

This chapter introduces the Enterprise Virtual Array components and explains how the host servers are integrated. The following topics are covered:

About virtualization

Virtualization is used to simplify the creation, presentation, and administration of storage to multivendor host servers in a storage area network (SAN). Virtualization changes the way the storage administrator interacts with storage—streamlining the work required to manage and implement the storage environment. This section describes how virtualization affects storage configuration.

You do not need to make decisions about planning, creating, and configuring stripesets, mirrorsets, and RAIDsets. The software now automates these decisions. The decisions are simplified to basic choices on virtual disk capacity and redundancy levels. All of this work is done from a central location—Command View EVA. See the Command View EVA online help for more information.

Three levels of virtualization are possible within a SAN—server, fabric, and storage system.

- **Server level**—useful for small systems—StorageWorks Virtual Replicator implements small scale virtualization of storage in a Windows NT and 2000 environment.
- **Fabric level**—SAN-wide virtualization with increased efficiency.
- **Storage system level**—provides large volumes of pooled storage in virtual disks and simplifies management tasks.

The Enterprise Virtual Array implements storage system level virtualization. Virtualization technology, at the storage system level, creates *virtual disks*. These virtual disks are created using all the available physical disk drives, not individual or grouped sets of disks. The host recognizes and uses these virtual disks like any other disk device.

About the Enterprise Virtual Array

Storage system level virtualization allows you to focus on higher-level concerns regarding your specific storage needs.

With the Enterprise Virtual Array, you no longer need to manually present storage pools to the host servers. That is, you do not choose specific disks and sets of disks to create levels of redundancy. There is no need to decide which physical disks should be involved in each storage unit. When you create virtual disks, the entire set of disks in the cabinet is used for load balancing and sparing, which sets aside extra disk space for failure protection. The Enterprise Virtual Array improves performance because the data is written across many disks and not directed toward a single or specific set of disks.

Setup and management of virtualization is achieved with software and hardware resources. You have greater freedom and control with the following benefits:

- Faster performance with improved system response time
- All SAN and storage management done from a Web browser
- Simplified load-balanced storage
- Simplified decisions about physical disk setup and partitioning
- Increased bandwidth through the use of striping algorithms across many disks accessed with multiple spindles
- Simplified high-availability storage techniques
- Recovery from disk failures includes automatic load balancing

EVA3000 versus EVA5000

There are two Enterprise Virtual Array storage system models: EVA3000 and EVA5000. EVA3000 is an entry-level model that supports up to 56 disks in four enclosures and has one back-end Fibre Channel loop. The EVA5000 has two back-end Fibre Channel loops and supports up to 252 disks in 18 enclosures. The EVA5000 uses fiber optic FC cables on the back-end; EVA3000 uses copper FC cables. EVA3000 runs on HSV100 controllers while EVA5000 runs on HSV110 controllers.

HP StorageWorks Kits v3.0e for Enterprise Virtual Array include support for both EVA3000 and EVA5000.

Note: Unless otherwise specified, all references to an HSV110 controller or an HSV110 controller pair should be interpreted as the HSV110 or HSV100 controller or controller pair.

Storage configuration

All complex choices regarding physical disk usage that were previously made manually, are now performed by the software. The end result is overall better performance and less intervention.

The Command View EVA software automatically makes complex choices about physical disk usage. Virtual disks are created behind the scenes with this software. You make relatively simple choices regarding virtual disk capacity, which host to present to, and the level of redundancy.

The following list provides an overview of the storage configuration process for the Enterprise Virtual Array:

1. Initialize the storage system.
2. Create disk groups.
3. Add hosts to the storage system.
4. Create virtual disks.
5. Present virtual disks to hosts.

For more information on setting up the Enterprise Virtual Array, see the *Enterprise Virtual Array User Guide* and the Command View EVA online help system.

Hosts and the Enterprise Virtual Array

This section describes how the host servers fit in the overall Enterprise Virtual Array. Below is a list of the hosts that can attach and interact with the Enterprise Virtual Array:

- Windows NT, Windows 2000, Windows Server 2003
- Tru64 UNIX
- OpenVMS
- Sun Solaris
- HP-UX
- IBM AIX
- Linux
- Novell NetWare

Be sure you are running a supported version of each operating system in your SAN (see the platform-specific release notes for details).

Figure 1 and Figure 2 shows an overall SAN architecture for the Enterprise Virtual Array. The control center for the Enterprise Virtual Array is Command View EVA, which resides on a management appliance. The management appliance is accessed from a browser anywhere on the network.

The hosts are components of the Enterprise Virtual Array storage systems. These host servers attach to the storage pools of the Enterprise Virtual Array and use the virtual disks just like any other disk resource. To the host server, virtual disks appear the same as other storage system disk resources.

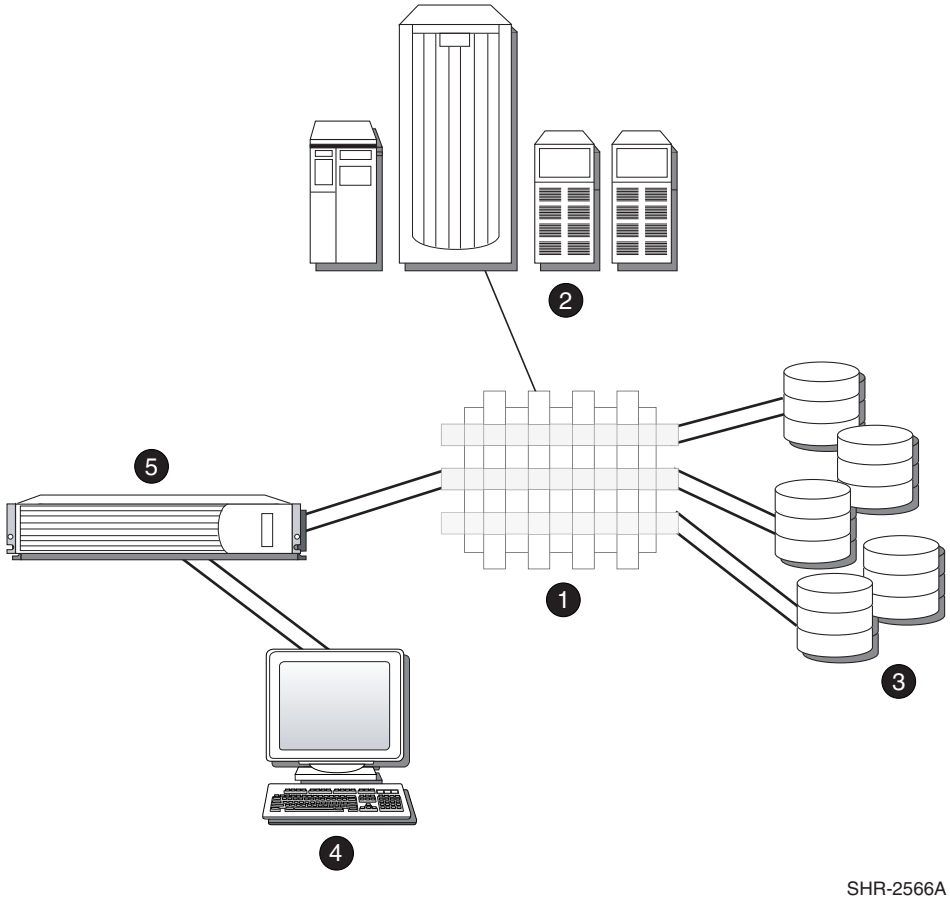

Figure 1: SAN architecture for a single-path environment

❶ Fabric

❷ Host servers

❸ Enterprise Virtual Array storage systems

❹ Browser for controlling Command View EVA

❺ Management Appliance—where Command View EVA resides

Note: The SAN must be zoned so that one port of the Enterprise Virtual Array is presented to the single-path server.

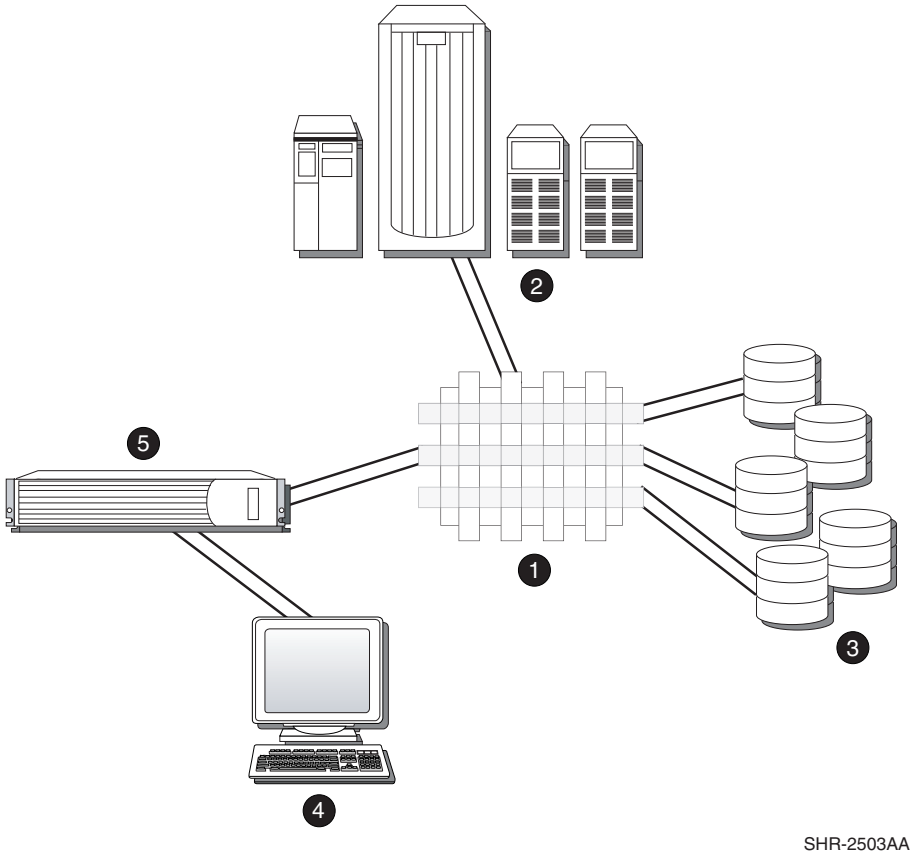

Figure 2: SAN architecture for a multi-path environment

❶ Fabric

❷ Host servers

❸ Enterprise Virtual Array storage systems

❹ Browser for controlling Command View EVA

❺ Management Appliance—where Command View EVA resides

Become familiar with the configuration requirements and the physical layout of your Enterprise Virtual Array. Refer to the documentation that came with your hardware. Also, read the documentation and release notes for the additional hardware and software used throughout your SAN.

SAN considerations

Ensure that your SAN components are all supported for use with the Enterprise Virtual Array. Design your SAN with an HP standard topology or by following the HP SAN design rules for creating custom topologies. Refer to the *HP StorageWorks SAN Design Reference Guide* for help with topology rules. The most up-to-date version of this guide can be found on the HP web site at http://h18004.www1.hp.com/products/storageworks/san/documentation.html

Host presentation compared with Enterprise Modular Array

In previous technology (Enterprise Modular Array family), the term *virtual disks* was used to describe what is presented to the host. Those virtual disks were derived from logical slices of storage, using specific sets of physical disks designed by the administrator.

With Enterprise Virtual Array, the disk pool used to derive virtual disks can be up to the entire set of physical disks available to the controllers. You do not need to be concerned with which physical disks are used to create the virtual disks. However, you do make decisions regarding disk groups, which are the number of physical disks used.

Virtual disks presented to the host servers with either technology appear like any other SAN disk resource. From the server side, there is no difference. Hosts access the virtual disks as a LUN with capacity knowledge.

Virtual RAID considerations

Virtual RAID helps determine the level to which user data is protected—VraidX, where *X* can be 0, 1, or 5. Redundancy is directly proportional to cost in terms of storage usage—the greater the level of data protection, the more storage space is required. There are three types of redundancy available with the Enterprise Virtual Array:

- **Vraid0**—No failure tolerance of data is provided.
- **Vraid1**—All data is duplicated within the storage system. This is the highest level of storage use with the lowest amount of read/write overhead.
- **Vraid5**—All data is protected by parity. This is the lowest level of storage use while maintaining redundancy at a cost of a higher amount of read/write overhead.

Installing the Linux Kit

2

This chapter provides instructions for installing the Linux Kit for Enterprise Virtual Array. This kit lets you connect host servers to the virtual disks of the Enterprise Virtual Array in a single- path configuration. The following topics are covered:

Installing the Fibre Channel adapter

Supported Fibre Channel adapters (FCAs) must be installed in the host server in order to communicate with the Enterprise Virtual Array. Refer to the platform-specific release notes for a list of supported FCAs.

Note: Traditionally, the adapter used to connect the host server to the fabric is called a host bus adapter (HBA). The HBA used in the Enterprise Virtual Array is called a Fibre Channel adapter (FCA). You may also see the adapter referred to as a Fibre Channel host bus adapter (FC HBA) in other related documents.

Follow the hardware installation rules and conventions for your server type. The Fibre Channel adapter is shipped with its own documentation for installation. Refer to that documentation for complete instructions.

Note: "Installing the host kit" on page 22 describes how to update the drivers to the Enterprise Virtual Array supported version

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You need the following items to begin:

- FCA boards and the installation instructions included with the adapter kit
- CD-ROM to install the FCA drivers
- The computer's hardware manual for instructions on installing adapters
- Appropriate tools to service your computer

The FCA board plugs into a standard PCI slot in the host computer. Refer to the system manual for instructions on plugging in boards.

Installing multi-pathing

The Enterprise Virtual Array can have a multiple-path environment. Secure Path or multi-pathing for Linux provides this multiple-path environment.

Refer to *HP StorageWorks Linux Kit v3.0e for Enterprise Virtual Array Release Notes* for the latest Secure Path or multi-pathing information.

Installing the host kit

The Linux Kit v3.0e for Enterprise Virtual Array installs the supported FCA driver and the Storage System Scripting Utility (SSSU).

The HSV controllers can be configured with SSSU as an alternate to Command View EVA. SSSU allows a command line interface for issuing commands directly to the controller. Complex configuration requests and operations can be handled by either Command View EVA or SSSU. Simple or initial configuration requests can be handled easily through Command View EVA, but repetitious and complex configuration steps can be scripted and executed through the command line interface.

See the *HP StorageWorks Storage System Scripting Utility Reference Guide* for more information on using the SSSU. The reference guide is included in the web kit.

Downloading the host kit software from the web

The Linux Kit v3.0e for Enterprise Virtual Array is available for download from http://www.hp.com/go/evaplatformkit/. You can save the software to your computer or create a CD-ROM. platform kit software is stored on the download Web site based on operating system. Follow the steps below to obtain the software from the Web site.

1. Go to http://www.hp.com/go/evaplatformkit/.
2. Select the kit for download.
3. Enter `EVA5000` in the **enter model product number** field.
4. Select the folder in which you want to save the file when presented with the **Save As** dialog box.

Note: The folder you select must be large enough to store the OS kit selected. File size ranges from 17 to 70 MB depending on the operating system selected.

The platform kit software is available as a `.iso` or `.zip` file. After you download and uncompress the files, your options are:

- Create a CD-ROM using the `.iso` file.
- Copy the `.zip` file to the server that runs the platform kit software. Uncompress the file and run the install program on the server.

Installing SSSU only

If you have already installed the FCA drivers, you can choose to install just the SSSU. The following SSSU install procedure assumes that you have loaded the web kit to a CD-ROM.

1. Mount the CD-ROM.
2. Change to the RPMS directory.
3. Enter the following command:

```
# rpm -ivh sssu-<version>.rpm
```

Refer to the Quick Checklist section to ensure you have correctly installed and configured all of the hardware and software in the SAN.

Installing the platform kit

To install the platform software, perform the following steps:

1. Mount the platform software CD. For example:

   ```
   # mount /dev/cdrom /mnt/cdrom
   ```

2. Execute the command `./install_stgwks.v3e.`

The script will install all the components. It will check for the correct architecture and distribution and install the correct driver RPM. The script also installs the *fibreutils* and *sssu* RPMs.

Uninstalling the platform kit

To uninstall the platform kit, execute the following steps:

1. Mount the solution software CD-ROM. For example:

   ```
   # /dev/cdrom /mnt/cdrom
   ```

2. Execute the command `./install_stgwks.v3e –u`

Getting more information

For more information, refer to the *HP StorageWorks Using the QLogic 7.00.03 Driver for Single-path or Multi-path Failover Mode on Linux Systems application note*.

Testing Connections to the Enterprise Virtual Array

3

This chapter describes how to test connections between Linux host servers and the Enterprise Virtual Array. This chapter also describes how to test connections between the Storage System Scripting Utility (SSSU) and the Enterprise Virtual Array. The following topics are covered:

Testing the Storage System Scripting Utility

The Storage System Scripting Utility (SSSU) is installed from the Linux Kit v3.0e for Enterprise Virtual Array (see Installing multi-pathing" on page 21). You should verify that SSSU runs from your host server. To verify that the sssu starts correctly on your system, issue the following command:

```
# sssu
```

You should see the sssu command prompt.

Testing connectivity to virtual disks

Virtual disks need to be set up and presented to your host server in order to test the connectivity and to begin using them. This section briefly describes how to create, present, and access virtual disks.

Host connectivity to the fabric

Once you have installed the FCA, you need to connect the host to the switches. Refer to "Connecting hosts to switches" on page 31 for the specific cabling instructions.

Adding hosts

You add a host using Command View EVA. You need to add each FCA installed in the host system in order for the host to work with the Enterprise Virtual Array.

1. Collect information on the WWN for each FCA on your server You need this information when choosing the host FCAs in Command View EVA.

   Adding hosts through the Command View EVA software consists of adding each FCA adapter installed in the host. The first step uses the **Add Host** function, and each subsequent adapter uses the **Add Port** function. Ensure that you add a port for each active FCA.

2. Add the host from Command View EVA.
3. Ensure that the host FCAs have been added by inspecting the **Host** folder in the **Navigation** tree of Command View EVA.

Creating and presenting virtual disks

This section describes how to create and present additional virtual disks to host servers and verify that the hosts can access them.

1. Create a virtual disk family on the Enterprise Virtual Array using Command View EVA.
2. Set values for the following:
   - Virtual Disk Name
   - Vraid level
   - Size
   - Present to host (preferably to the host you just created)
3. If you chose a specific LUN on the **Virtual Disk Properties** page, you are prompted to select a LUN number.

Note: You must set the host connection type to Sun Solaris.

Verifying virtual disks from the host

To verify that you can see the virtual disks that you just created for the host, enter the following command:

```
# more /proc/scsi/scsi
```

This file is a listing of all SCSI devices your Linux server sees. An entry for an EVA LUN will look similar to the following:

```
Host: scsi0 Channel: 00 Id: 06 Lun: 01
Vendor: COMPAQ   Model: HSV110 (C)COMPAQ Rev: 3000
Type:   Direct-Access ANSI SCSI revision: 02
```

Configuring virtual disks from the host

After you have set up the virtual disks on the Enterprise Virtual Array and have rescanned or restarted the host, you need to follow the host-specific conventions for configuring these new disk resources. These disk resources then become usable just like any other disk resource to the host system. Refer to the documentation that came with your server for specific instructions on setting up disk resources.

Additional Host Considerations

4

This chapter includes additional considerations for the host operating systems in an Enterprise Virtual Array. The following topics are covered:

Connecting hosts to switches

This section describes how to connect your host servers to the SAN switches in order to access the virtual disks. The documentation that came with the Enterprise Virtual Array hardware describes how to cable the controllers to the SAN switches.

Each host must attach to one or two redundant switches (fabric) using standard fiber channel cables depending upon the configuration (single- or multiple-path). Each host has at least one FCA connected (single-path) through switches on a SAN to one port of an Enterprise Virtual Array.

Note: For single-path, ensure that the path is zoned. Refer to the *HP StorageWorks SAN Design Reference Guide* for zoning instructions.

For multiple-path, use the following cabling procedure:

1. Plug one end of the fiber channel cable into the FCA on the servers. There must be at least two FCAs.
2. Plug the other end of the cable into the switch.

Figure 3 displays the connections between a single server with two FCAs and two switches.

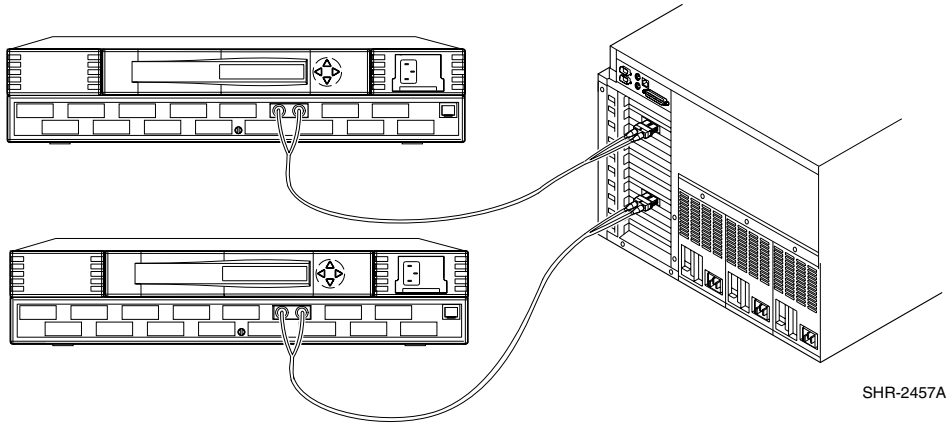

Figure 3: Cabling hosts to switches

For single-path environments, use the following cabling procedure:

1. Plug one end of the fiber channel cable into the FCA on the server.
2. Plug the other end of the cable into the switch.

Figure 4 displays the connections between a single server with one FCA and one switch.

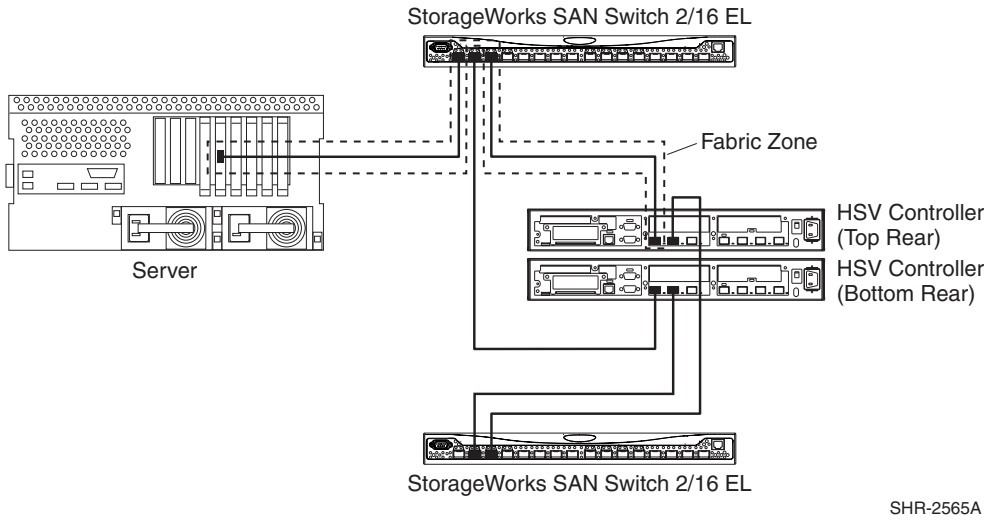

Figure 4: Single-path cabling diagram

SSSU for VCS version 3.0

The version of SSSU that came with the v3.0 kit is also included in the Linux v3.0e kit. The v3.0e kit version for SSSU requires VCS version 3.010 or greater to operate correctly. If you are using a previous version of VCS, you can install the previous version of the SSSU by installing the `ENTsssu-5.72.rpm` RPM from the RPMS directory of the web kit.

Glossary

This glossary defines Enterprise Virtual Array terms used in this publication or related to this product and is not a comprehensive glossary of computer terms.

active virtual disk
A virtual disk (VD) is a simulated disk drive created by the controllers as storage for one or more hosts. An active virtual disk is accessible by one or more hosts for normal storage. An active virtual disk and its snapshot, if one exists, constitute a virtual disk family. An active virtual disk is the only necessary member of a virtual disk family.

See also **virtual disk, virtual disk copy, virtual disk family,** *and* **snapshot.**

adapter
See **controller.**

array
All the physical disk drives in a storage system that are known to, and under the control of, a controller pair.

array controller
See **controller.**

cable assembly
A fiber optic cable that has connectors installed on one or both ends. General use of these cable assemblies includes the interconnection of multimode fiber optic cable assemblies with either LC or SC type connectors.

- When there is a connector on only one end of the cable, the cable assembly is referred to as a pigtail.
- When there is a connector on both ends of the cable, the cable assembly is referred to as a jumper.

cache
High-speed memory that sets aside data as an intermediate data buffer between a host and the storage media. The purpose of cache is to improve performance.

See also **read cache, write cache,** *and* **mirrored cache.**

communication logical unit number (LUN)
See **console LUN.**

console LUN
A SCSI-3 virtual object that makes a controller pair accessible by the host before any virtual disks are created. Also called a communication LUN.

console LUN ID
The ID that can be assigned when a host operating system requires a unique ID. The console LUN ID is assigned by the user, usually when the storage system is initialized.

See also **console LUN.**

controller
A hardware/firmware device that manages communications between host systems and other devices. Controllers typically differ by the type of interface to the host and provide functions beyond those the devices support.

controller pair
Two interconnected controller modules which together control a physical disk array. A controller pair and the disk array together constitute a storage system.

Enterprise Virtual Array
The HP name used to describe the storage system that includes HSV controllers, storage devices, enclosures, cables, and power supplies. *Also* called the Enterprise Storage System.

fabric
A Fibre Channel fabric switch, or two or more interconnected Fibre Channel switches allowing data transmission.

fabric port
A port that is capable of supporting an attached arbitrated loop. This port on a loop will have the AL_PA hexadecimal address 00 (loop ID 7E), giving the fabric the highest priority access to the loop. A loop port is the gateway to the fabric for the node ports on a loop.

failover
The process that takes place when one controller assumes the workload of a failed companion controller. Failover continues until the failed controller is operational.

FC HBA
Fibre Channel host bus adapter. An interchangeable term for Fibre Channel adapter.

See also **FCA.**

FCA
Fiber Channel Adapter. An adapter used to connect the host server to the fabric. *Also* called a host bus adapter (HBA) or a Fibre Channel host bus adapter (FC HBA).

See also **FC HBA.**

fiber
The optical media used to implement Fibre Channel.

fibre
The international spelling that refers to the Fibre Channel standards for optical media.

Fibre Channel
A data transfer architecture designed for mass storage devices and other peripheral devices that require very high bandwidth.

Fibre Channel adapter
See **FCA.**

GB
Gigabyte. A unit of measurement defining either:

- A data transfer rate.
- A storage or memory capacity of 1,073,741,824 (2^{30}) bytes.

See also **GBps.**

GBps
Gigabytes per second. A measurement of the rate at which the transfer of bytes of data occurs. A GBps is a transfer rate of 1,000,000,000 (10^9) bits per second.

See also **GB.**

Giga (G)
The notation to represent 10^9 or 1 billion (1,000,000,000).

HBA
host bus adapter.

See **FCA.**

host
A computer that runs user applications and uses (or can potentially use) one or more virtual disks created and presented by the controller pair.

host bus adapter
See also **FCA, HBA.**

host computer
See **host.**

host ports
A connection point to one or more hosts through a Fibre Channel fabric. A host is a computer that runs user applications and that uses (or can potentially use) one or more of the virtual disks that are created and presented by the controller pair.

host-side ports
See **host ports.**

initialization
A process that prepares a storage system for use. Specifically, the system binds controllers together as an operational pair and establishes preliminary data structures on the disk array. Initialization also sets up the first disk group, called the default disk group.

K
Kilo. A scientific notation denoting a multiplier of one thousand (1,000).

KB
Kilobyte. A unit of measurement defining either storage or memory capacity.

- For storage, a KB is a capacity of 1,000 (10^3) bytes of data.
- For memory, a KB is a capacity of 1,024 (2^{10}) bytes of data.

LUN
Logical Unit Number. A unique identifier used on an SCSI bus to distinguish between devices that share the same bus. SCSI is a parallel interface that allows up to eight devices to be connected along a single cable.

management agent
Command View EVA software that controls and monitors the Enterprise Storage System. The software can exist on more than one management appliance in a fabric. Each installation of the Command View EVA software is a management agent.

MB
Megabyte. A term defining either:

- A data transfer rate.
- A measure of either storage or memory capacity of 1,048,576 (2^{20}) bytes.

See also **MBps.**

MBps
Megabytes per second. A measure of bandwidth or data transfers occurring at a rate of 1,000,000 (10^6) bytes per second.

Mega
A notation denoting a multiplier of 1 million (1,000,000).

metadata
Information that a controller pair writes on the disk array. This information is used to control and monitor the array and is not readable by the host.

mini-port driver
The Windows driver type used for connecting to the Enterprise Virtual Array through the SAN fabric.

mirrored caching
A process in which half of each controller's write cache mirrors the companion controller's write cache. The total memory available for cached write data is reduced by half, but the level of protection is greater.

mirroring
The act of creating an exact copy or image of data.

node port
A device port that can operate on the arbitrated loop topology.

NSC
Network Storage Controller. The HSV Controllers used by the Enterprise Storage System.

OSM
Open SAN Manager. A centralized, appliance-based monitoring and management interface that supports multiple applications, operating systems, hardware platforms, storage systems, tape libraries, and SAN-related interconnect devices. It is included and resides on the management appliance, a single aggregation point for data management.

password
A security interlock whose purpose is to allow:

- A management agent control of only certain storage systems
- Only certain management agents control of a storage system

physical disk
A disk drive mounted in a disk drive enclosure that communicates with a controller pair through the device-side Fibre Channel loops. A physical disk is hardware with embedded software, as opposed to a virtual disk, which is constructed by the controllers. Only the controllers can communicate directly with the physical disks.

The physical disks, in aggregate, are called the array and constitute the storage pool from which the controllers create virtual disks.

physical disk array
See **array**.

port
A Fibre Channel connector on a Fibre Channel device.

port_name
A 64-bit unique identifier assigned to each Fibre Channel port. The port_name is communicated during the login and port discovery processes.

preferred path
A preference for which controller of the controller pair manages the virtual disk. This preference is set by the user through the Command View EVA when creating the virtual disk. A host can change the preferred path of a virtual disk at any time. The primary purpose of preferring a path is load balancing.

read ahead caching
A cache management method used to decrease the subsystem response time to a read request by allowing the controller to satisfy the request from the cache memory rather than from the disk drives.

read caching
A cache method used to decrease subsystem response times to a read request by allowing the controller to satisfy the request from the cache memory rather than from the disk drives. Reading data from cache memory is faster than reading data from a disk. The read cache is specified as either on or off for each virtual disk. The default state is on.

redundancy
- Element Redundancy—The degree to which logical or physical elements are protected by having another element that can take over in case of failure. For example, each loop of a device-side loop pair normally works independently but can take over for the other in case of failure.
- Data Redundancy—The level to which user data is protected. Redundancy is directly proportional to cost in terms of storage usage; the greater the level of data protection, the more storage space is required.

SCSI
- Small Computer System Interface. An American National Standards Institute (ANSI) interface that defines the physical and electrical parameters of a parallel I/O bus used to connect computers and a maximum of 16 bus elements.
- The communication protocol used between a controller pair and the hosts. Specifically, the protocol is FC-AL or SCSI on a Fibre Channel. SCSI is the higher command-level protocol and Fibre Channel is the low-level transmission protocol. The controllers have full support for SCSI-2; additionally, they support some elements of SCSI-3.

SCSI-3
The ANSI standard that defines the operation and function of Fibre Channel systems.

small computer system interface
See **SCSI.**

SMART
Self-Monitoring, Analysis, and Reporting Technology. An industry standard for running internal diagnostics on disk drives and making predictive failure analysis. If a physical disk drive reports an imminent failure, the controllers redistribute data to other drives. The SMART message is reported and should trigger the immediate corrective action to replace the drive.

snapshot
A temporary virtual disk (VD) that reflects the contents of another virtual disk at a particular point in time. A snapshot operation is done only on an active virtual disk. Only one snapshot of an active virtual disk can exist at any point. The active disk and its snapshot constitute a virtual family.

See also **active virtual disk, virtual disk copy,** *and* **virtual disk family.**

SSN
Storage System Name. A Command View EVA-assigned, unique 20-character name that identifies a specific storage system.

storage pool
The aggregated blocks of available storage in the total physical disk array.

storage system
The controllers, storage devices, enclosures, cables, and power supplies and their software.

Storage System Scripting Utility (SSSU)
A command-line application supplied in the host operating system kits that allows for control of the Enterprise Virtual Array.

Storage System Name
See **SSN.**

StorageWorks
The HP name used to describe the set of rack-mounted enclosures containing controllers, transceivers, I/O modules, EMUs, disk drives, cables, blowers, and power supplies used to design and configure a solution-specific storage system.

switch
An electromechanical device that initiates an action or completes a circuit.

TB
Terabyte. A term defining either:

- A data transfer rate.
- A measure of either storage or memory capacity of 1,099,5111,627,776 (2^{40}) bytes.

See also **TBps.**

TBps
Terabytes per second. A data transfer rate of 1,000,000,000,000 (10^{12}) bytes per second.

uninitialized system
A state in which the storage system is not ready for use.

See also **initialization.**

virtual disk
A simulated disk drive created by the controllers as storage for one or more hosts. The virtual disk characteristics, chosen by the storage administrator, provide a specific combination of capacity, availability, performance, and accessibility. A controller pair simulates the characteristics of the virtual disk by deploying the disk group from which the virtual disk was created.

The host computer sees the virtual disk as “real,” with the characteristics of an identical physical disk.

See also **active virtual disk, virtual disk copy, virtual disk family,** *and* **virtual disk snapshot**.

virtual disk copy
A clone or exact replica of another virtual disk at a particular point in time. Only an active virtual disk can be copied. A copy immediately becomes the active disk of its own virtual disk family.

See also **active virtual disk, virtual disk family,** *and* **virtual disk snapshot**.

virtual disk family
A virtual disk and its snapshot, if a snapshot exists, constitute a family. The original virtual disk is called the active disk. When you first create a virtual disk family, the only member is the active disk.

See also **active virtual disk, virtual disk copy,** *and* **virtual disk snapshot**.

virtual disk snapshot
See **snapshot**.

Vraid0
A virtualization technique that provides no data protection. Data from the host is broken down into chunks and distributed on the disks comprising the disk group from which the virtual disk was created. Reading and writing to a Vraid0 virtual disk is very fast and makes the fullest use of the available storage, but there is no data protection (redundancy) unless there is parity.

Vraid1
A virtualization technique that provides the highest level of data protection. All data blocks are mirrored or written twice on separate physical disks. For read requests, the block can be read from either disk, which can increase performance. Mirroring takes the most storage space because twice the storage capacity must be allocated for a given amount of data.

Vraid5
A virtualization technique that uses parity striping to provide moderate data protection. Parity is a data protection mechanism for a striped virtual disk. A striped virtual disk is one whose data to and from the host is broken down into chunks and distributed on the physical disks comprising the disk group in which the virtual disk was created. If the striped virtual disk has parity, another chunk (a parity chunk) is calculated from the set of data chunks and written to the physical disks. If one of the data chunks becomes corrupted, the data can be reconstructed from the parity chunk and the remaining data chunks.

World Wide Name
See **WWN**.

write-back caching
A controller process that notifies the host that the write operation is complete when the data is written to the cache. This occurs before transferring the data to the disk. Write back caching improves response time because the write operation completes as soon as the data reaches the cache. As soon as possible after caching the data, the controller then writes the data to the disk drives.

write caching
A process wherein the host sends a write request to the controller, and the controller places the data in the controller cache module. As soon as possible, the controller transfers the data to the physical disk drives.

WWN
World Wide Name. A unique Fibre Channel identifier consisting of a 16-character hexadecimal number. A WWN is required for each Fibre Channel communication port.

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